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# DEVICE SPECIFICATIONS FOR

# TFT-LCD module

# MODEL No.PN-MG605

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

Engineerring Department I

BY Kenji Tanaka

2011. June 21st.

# RECORDS OF REVISION

MODEL NO.PN-MG605

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LM10075 | 2010. Dec.21 | | | Preliminary version | |
| | 2011.Jan. 21 | 1-2 | 8 | Tsfc, [NOTE4] in Absolute Maximum Rating are added | |
| | 2011.Feb. 3 | 3 | | Revision | |
| | | | 2 | "Weigt" was determined. | |
| | | | 13 | Pallet gross weight and Carton gross weight are added | |
| | | | | Test temperature and state( [Note] )are added | |
| | | | 14 | Module Label is added and Material Label explanation is corrected. | |
| | | | 15 | Packing form are changed | |
| | | | 16 | Tolerance are added to Outline dimensions. | |
| | | | 17 | Environmental Impact Substances Information are added. | |
| | 2011. Feb. 4 | | | authoritative version issued | |
| | 2011.June.16 | 4 | 13,15 | Packing form has been changed | |
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## 1. Application

This specifications applies to the color 60.0" TFT-LCD module PN-MG605.

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## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit and LED back light system etc. Graphics and texts can be displayed on a 1366×RGB×768 dots panel with about 16.77 million colors by using 8bit LVDS (Low Voltage Differential Signaling) to interface and +12V of DC supply voltages.

And in order to improve the response time of LCD, this LCD module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

## 3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---|---|---|
| Display size | 152.439(Diagonal) | cm |
| | 60.0 (Diagonal) | inch |
| Active area | 1328.7765 (H)×747.072 (V) | mm |
| Pixel format | 1366 (H)×768 (V)<br>(1 pixel＝R+G+B dots) | pixel |
| Pixel pitch | 0.97275 (H)×0.97275 (V) | mm |
| Pixel configuration | R, G, B vertical stripe | |
| Display mode | Normally black | |
| Unit outline dimensions (*1) | 1335.9 (W)×754.2 (H)×104.2 (D) | mm |
| Weight | △3 28.2±2.0 | kg |
| Surface treatment | LR coating<br>Hard coating: 2H and more | |

(*1)Outline dimensions are shown in Fig.3

## 4. Input Terminals

4-1. TFT-LCD panel driving

CN1 (Interface signals)

Using connectors : FX16S-41S-0.5SH (HIROSE)

Mating connectors : FX16M1-41P-HC (HIROSE)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | Reserved | - | Must be OPEN |
| 2 | Reserved | - | Must be OPEN |
| 3 | Reserved | - | Must be OPEN |
| 4 | Reserved | - | Must be OPEN |
| 5 | GND | GND | |
| 6 | GND | GND | |
| 7 | GND | GND | |
| 8 | GND | GND | |
| 9 | LVDS_SEL | Select LVDS data order [Note 1] | Pull Up : (+3.3V) |
| 10 | Reserved | - | Must be OPEN |
| 11 | GND | GND | |
| 12 | RX0- | LVDS CH0 differential data input(-) | |
| 13 | RX0+ | LVDS CH0 differential data input(+) | |
| 14 | GND | GND | |
| 15 | RX1- | LVDS CH1 differential data input(-) | |
| 16 | RX1+ | LVDS CH1 differential data input(+) | |
| 17 | GND | GND | |
| 18 | RX2- | LVDS CH2 differential data input(-) | |
| 19 | RX2+ | LVDS CH2 differential data input(+) | |
| 20 | GND | GND | |
| 21 | RXCLK- | LVDS Clock input(-) | |
| 22 | RXCLK+ | LVDS Clock input(+) | |
| 23 | GND | GND | |
| 24 | RX3- | LVDS CH3 differential data input(-) | |
| 25 | RX3+ | LVDS CH3 differential data input(+) | |
| 26 | GND | GND | |
| 27 | Reserved | - | Must be OPEN |
| 28 | Reserved | - | Must be OPEN |
| 29 | GND | GND | |
| 30 | Reserved | - | Must be OPEN |
| 31 | Reserved | - | Must be OPEN |
| 32 | Reserved | - | Must be OPEN |
| 33 | GND | GND | |
| 34 | GND | GND | |
| 35 | GND | GND | |
| 36 | GND | GND | |
| 37 | GND | GND | |
| 38 | Reserved | - | Must be OPEN |
| 39 | Reserved | - | Must be OPEN |
| 40 | Reserved | - | Must be OPEN |
| 41 | Reserved | - | Must be OPEN |

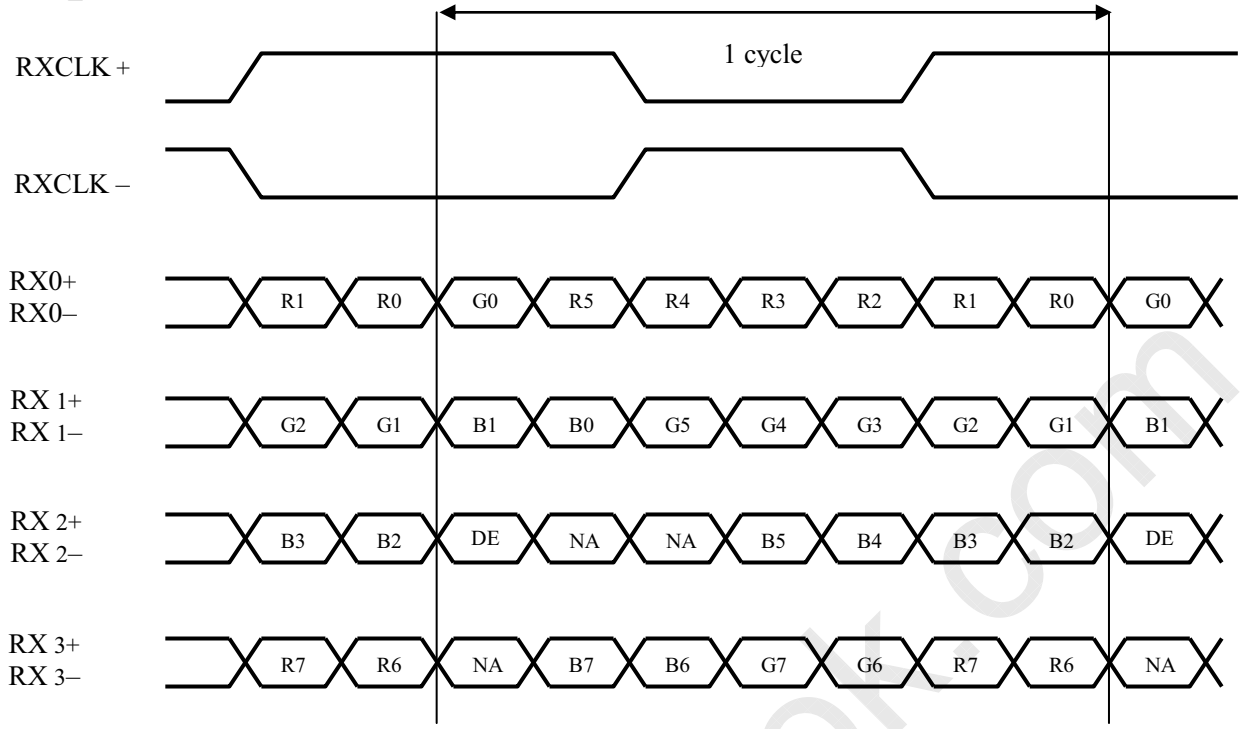
[Note 1] LVDS Data order

| LVDS_SEL | | |
|---|---|---|
| Data | L(GND)<br>[VESA] | H(3.3V) or Open<br>[JEIDA] |
| TA0 | R0(LSB) | R2 |
| TA1 | R1 | R3 |
| TA2 | R2 | R4 |
| TA3 | R3 | R5 |
| TA4 | R4 | R6 |
| TA5 | R5 | R7(MSB) |
| TA6 | G0(LSB) | G2 |
| TB0 | G1 | G3 |
| TB1 | G2 | G4 |
| TB2 | G3 | G5 |
| TB3 | G4 | G6 |
| TB4 | G5 | G7(MSB) |
| TB5 | B0(LSB) | B2 |
| TB6 | B1 | B3 |
| TC0 | B2 | B4 |
| TC1 | B3 | B5 |
| TC2 | B4 | B6 |
| TC3 | B5 | B7(MSB) |
| TC4 | NA | NA |
| TC5 | NA | NA |
| TC6 | DE(*) | DE(*) |
| TD0 | R6 | R0 |
| TD1 | R7 | R1 |
| TD2 | G6 | G0 |
| TD3 | G7 | G1 |
| TD4 | B6 | B0 |
| TD5 | B7 | B1 |
| TD6 | NA | NA |

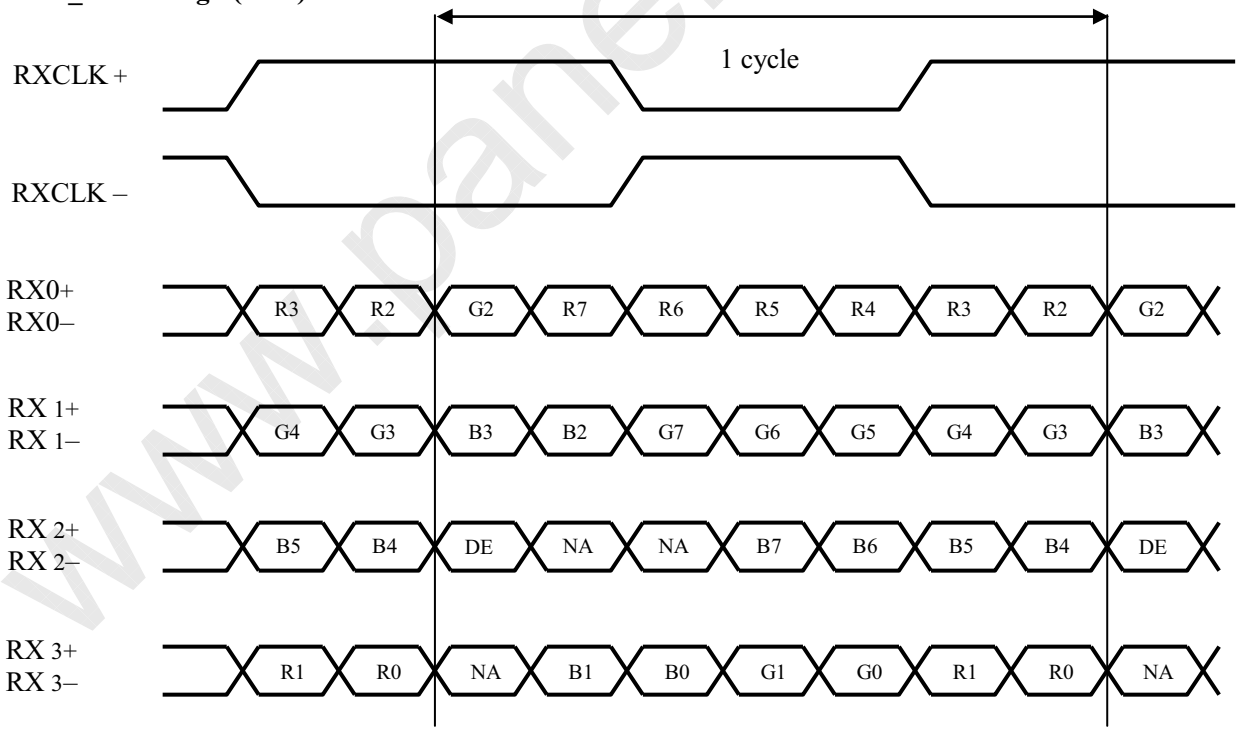
NA: Not Available

(*)Since the display position is prescribed by the rise of DE(Display Enable)signal, please do not fix DE signal during operation at ”High”.

**LVDS_SEL = Low (GND)**




**LVDS_SEL = High (3.3V) or OPEN**




DE: Display Enable, NA: Not Available (Fixed Low)

CN2 (+12V DC power supply)

Using connectors : SM05B-PASS (JST)

Mating connectors : PAP-05V-S (JST)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | VCC | +12V Power Supply | |
| 2 | VCC | +12V Power Supply | |
| 3 | GND | GND | |
| 4 | GND | GND | |
| 5 | NC | | |

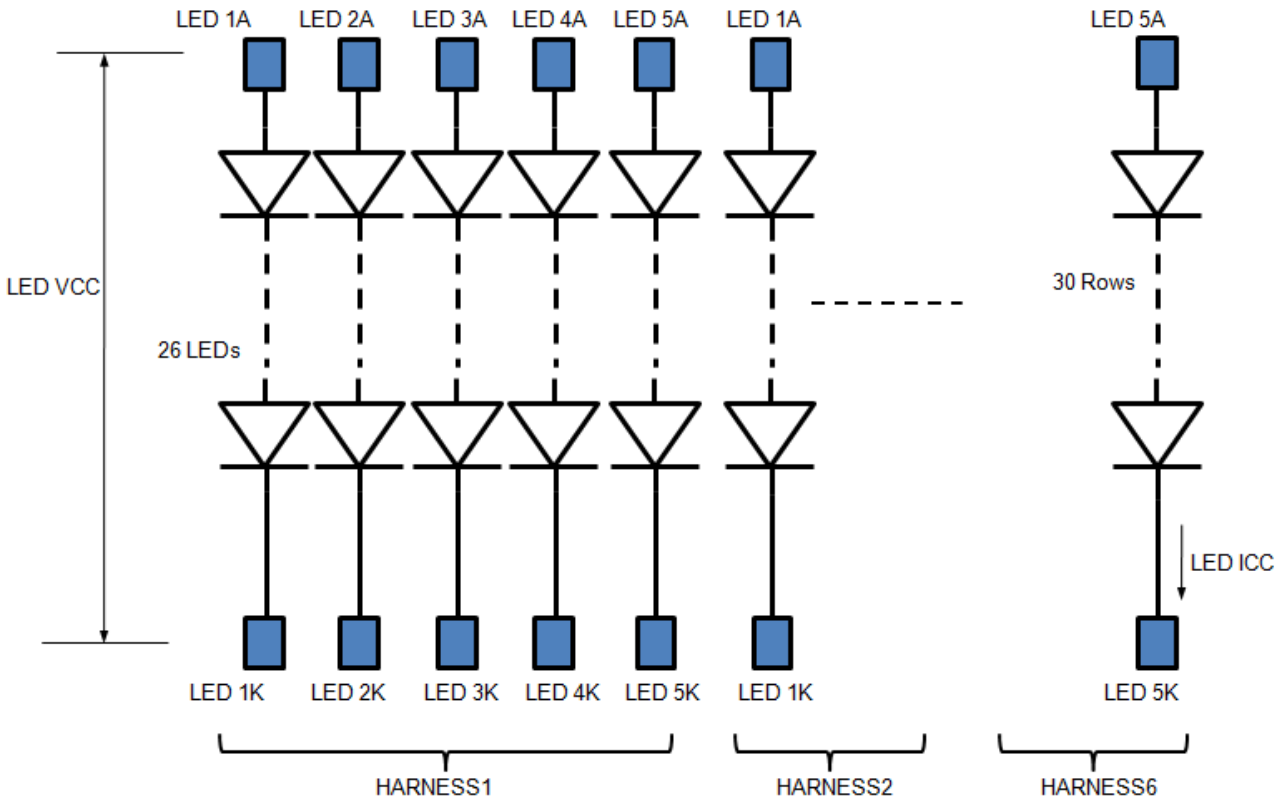
LED HARNESS1 - 6 (LED Power supply)

Using connectors : 51284-1000 or 51284-1001 (MOLEX)

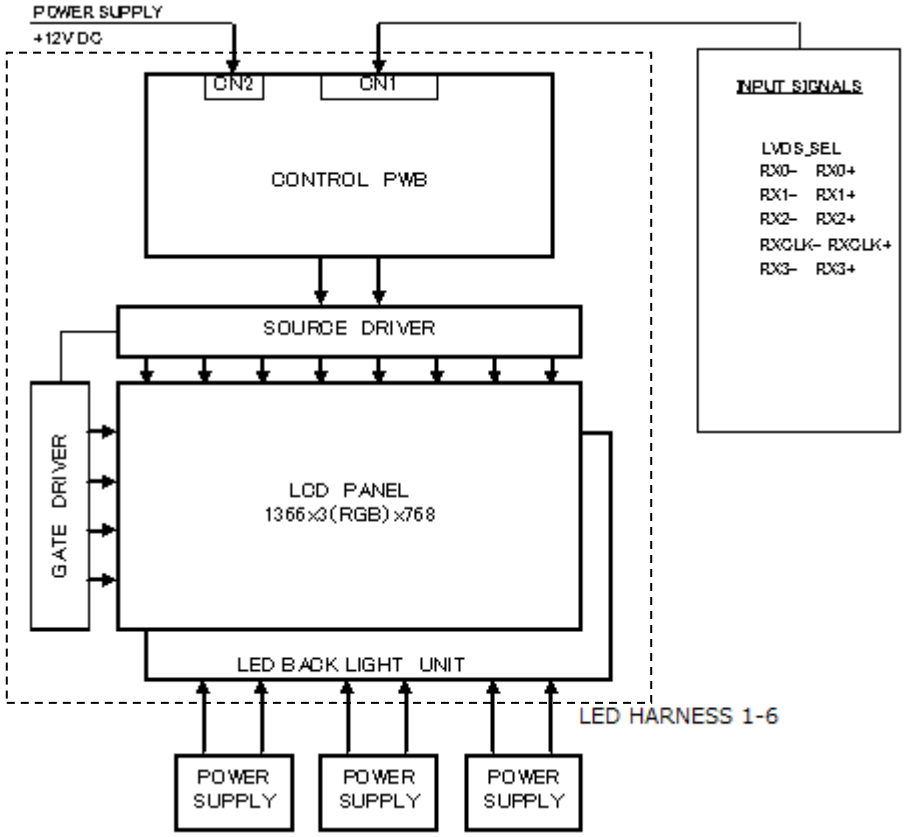
Mating connectors : 55883-1090 or 55883-1091 (MOLEX)

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| 1 | LED 1A | LED Anode1 | |
| 2 | LED 2A | LED Anode2 | |
| 3 | LED 3A | LED Anode3 | |
| 4 | LED 4A | LED Anode4 | |
| 5 | LED 5A | LED Anode5 | |
| 6 | LED 1K | LED Cathode1 | |
| 7 | LED 2K | LED Cathode2 | |
| 8 | LED 3K | LED Cathode3 | |
| 9 | LED 4K | LED Cathode4 | |
| 10 | LED 5K | LED Cathode5 | |

LED BACK LIGHT Diagram



4-2. Interface block diagram




4.3. The back light system characteristics

The back light system is direct type with 780 LEDs.

The characteristics of the LED are shown in the following table.

| Item | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Life time | $T_L$ | — | (37000) | — | Hour | [NOTE] |

[NOTE]

- LED life time is defined as the time when brightness become 70% of the original value in the continuous Operation under the condition of Ta=25℃

## 5. Absolute Maximum Rating

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
|---|---|---|---|---|---|
| Input Voltage (for Control) | $V_I$ | Ta=25℃ | -0.3 ～ 3.6 | V | [NOTE1] |
| 12V supply voltage (for Control) | VCC | Ta=25℃ | 0 ～ 14 | V | |
| Forward current (for LED) | $I_F$ | Ta=25℃ | 80 | mA | Tc≦74.1℃ |
| Reverse voltage (for LED) | $V_R$ | Ta=25℃ | 130 | V | Maximum 5V for each LED |
| Storage temperature | $T_{stg}$ | | -25 ～ 60 | ℃ | |
| Operation temperature (Ambient) | $T_{opa}$ | | 0 ～ 50 | ℃ | [NOTE2] |
| LED terminal temperature | Tc | | 0 ～ 80 | ℃ | [NOTE3], [NOTE4] |
| △1 LCD surface temperature | Tsfc | | 0 ～ 60 | ℃ | [NOTE4] |

[NOTE1] LVDS_SEL
[NOTE2] Humidity 95% RH Max (Ta≦40℃)
Maximum wet-bulb temperature should be less than 40℃.(Ta＞40℃)
No condensation.
△2 [NOTE3] LED terminal temperature should be measured on the LED PWBs.
[NOTE4] Tc and Tsfc in operation must be in the above range on any condition.

## 6. Electrical Characteristics

6.1 Control driving

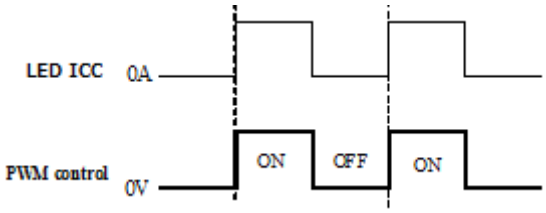
| Parameter | | Symbol | Min. | Typ. | Max | Unit | Remark |
|---|---|---|---|---|---|---|---|
| +12V supply voltage | Supply voltage | VCC | 11.4 | 12.0 | 12.6 | V | |
| | Current dissipation | ICC | | (1) | | A | |
| Permissible input ripple voltage | | $V_{RP}$ | — | — | 100 | mV | |
| Differential input threshold voltage | High | $V_{TH}$ | 1.3 | — | 1.8 | V | [NOTE2] |
| | Low | $V_{TL}$ | 0.6 | — | 1.1 | V | |
| Differential input leak current | | $I_{Iz}$ | -10 | | +10 | μA | |
| Input Low voltage | | $V_{IL}$ | — | — | 1.0 | V | [NOTE1] |
| Input High voltage | | $V_{IH}$ | 2.5 | — | 3.3 | V | |
| Input leak current (Low) | | $I_{IL1}$ | — | — | 400 | μA | $V_I$=0V [NOTE1] |
| Input leak current (High) | | $I_{IH1}$ | — | — | TBD | μA | $V_I$=3.3V [NOTE1] |
| Terminal resistor | | $R_T$ | — | 100 | — | Ω | |

[NOTE 1] LVDS_SEL(10kΩpull-up)
[NOTE 2] RXCLK±、RX0±、RX1±、RX2±、RX3±

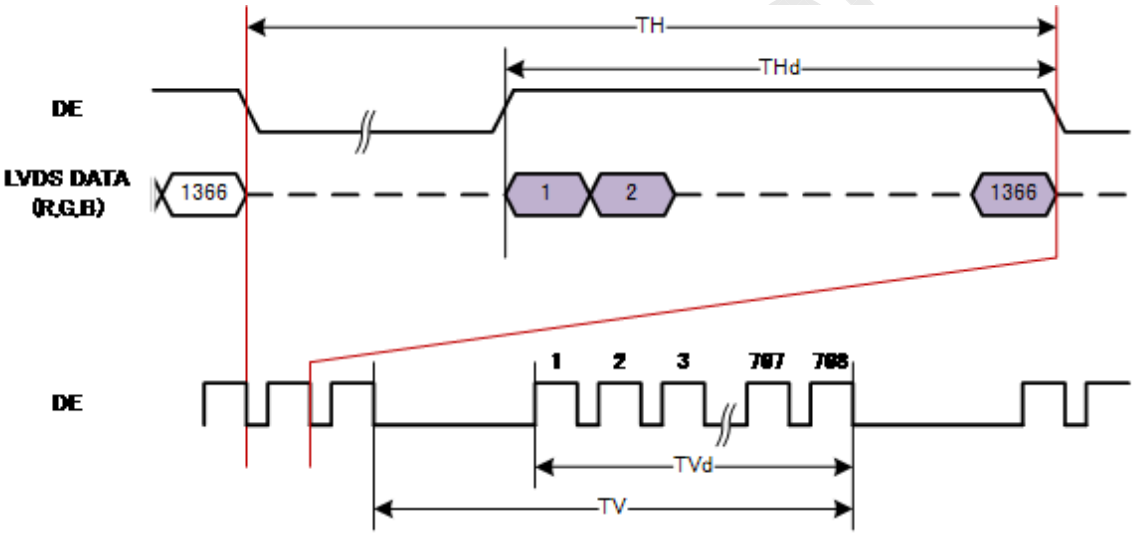
6.2 LED driving

| Parameter | Symbol | Min. | Typ. | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Input voltage | LED VCC | | (252.2) | | V | LED ICC=45mA [NOTE] |
| Input current | LED ICC | | (45) | 60 | mA | Each pin of LED HARNESS1 - 6 |

[NOTE 1] Measurement after 100ms has passed since power supply was turned on.
[NOTE 2] LED Brightness should be controlled by PWM method as shown below.




6.3 Timing characteristics of input signals




| Parameter | | Symbol | Min. | Typ. | Max. | 単位 | 備考 |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | | 83 | | MHz | |
| Data Enable | Horizontal period | TH | | 1696 | | clock | |
| | | | | 20.43 | | μsec | |
| | Horizontal period (High) | THd | — | 1366 | — | clock | |
| | Vertical period | TV | | 806 | | line | |
| | Vertical period (High) | TVd | — | 768 | — | line | |

**Fig.1 Timing characteristics of input signals**

## 7. Optical characteristics

Ta=25℃, VCC=12.0V, LED ICC=45mA, LED PWM Burst= 99.97% , Timing :60Hz (typ.value)

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Contrast ratio | | CRn | θ=0° | | 2400 | | — | [NOTE2,4] |
| Luminance of white | | x | θ=0° | | 0.292 | | | [NOTE4] |
| | | y | | | 0.307 | | | |
| Luminance of red | | x | | | 0.656 | | | |
| | | y | | | 0.337 | | | |
| Luminance of green | | x | | | 0.306 | | | |
| | | y | | | 0.641 | | | |
| Luminance of blue | | x | | | 0.152 | | | |
| | | y | | | 0.065 | | | |
| Viewing angle range | Horizontal | $\theta_{21},\theta_{22}$ | CR>10 | | 88 | | deg | [NOTE1,4] |
| | Vertical | $\theta_{11},\theta_{12}$ | | | 88 | | deg | |
| Luminance | | $Y_L$ | White θ=0° | | (700) | | $cd/m^2$ | |
| Luminance uniformity | | δw | | | (1.25) | | | [NOTE6] |
| Response time | | τ | θ=0° | | 6 | | ms | [NOTE3,4,5] |

Measurement condition : Set the LED PWM Burst to maximum

The measurement shall be executed 60 minutes after lighting at rating.

[Note]The optical characteristics are measured using the following equipment.

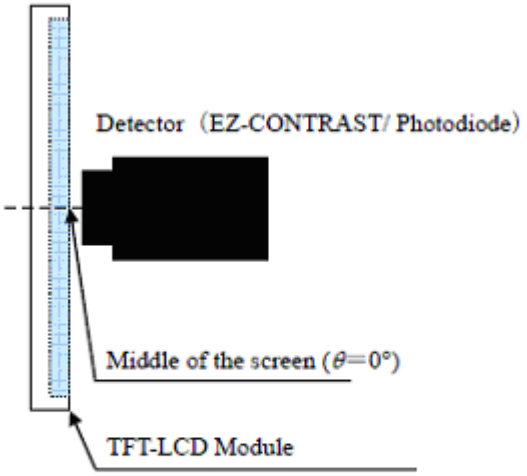



Fig.4-1 Measurement of viewing angle range and Response time.
Viewing angle range: EZ-CONTRAST
Response time: Photodiode

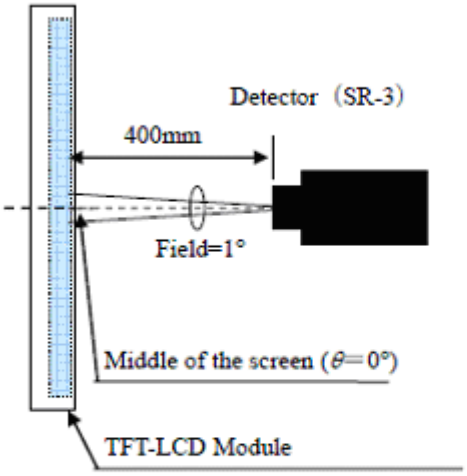
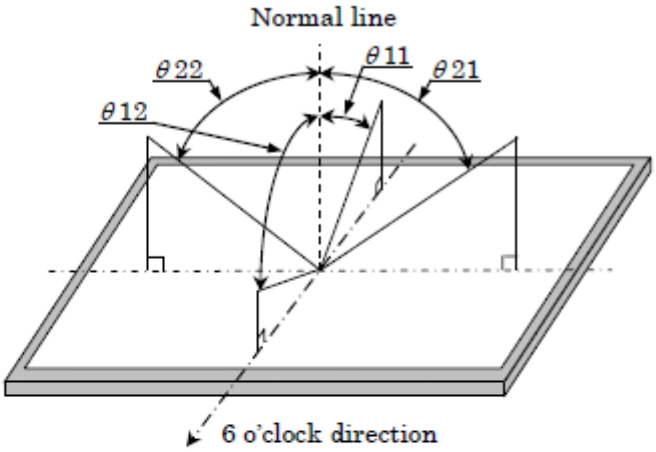



Fig.4-2 Measurement of Contrast, Luminance, Chromaticity.

[Note 1]Definitions of viewing angle range :




[Note 2]Definition of contrast ratio :

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

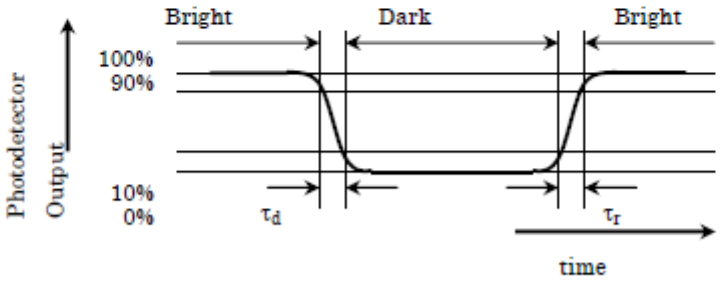
[Note 3]Definition of response time

The response time ($\tau_d$ and $\tau_r$) is defined as the following figure and shall be measured by switching the input signal for "any level of gray (0%, 25%, 50%, 75% and 100%)" and "any level of gray (0%, 25%, 50%, 75% and 100%)".

| | 0% | 25% | 50% | 75% | 100% |
|---|---|---|---|---|---|
| 0% | | tr:0%-25% | tr:0%-50% | tr:0%-75% | tr:0%-100% |
| 25% | td: 25%-0% | | tr: 25%-50% | tr25%-75% | tr: 25%-100% |
| 50% | td: 50%-0% | td: 50%-25% | | tr: 50%-75% | tr: 50%-100% |
| 75% | td: 75%-0% | td: 75%-25% | td: 75%-50% | | tr: 75%-100% |
| 100% | td: 100%-0% | td: 100%-25% | td: 100%-50% | td:100%-75% | |

t*:x-y...response time from level of gray(x) to level of gray(y)

$\tau_r = \Sigma(tr:x\text{-}y)/10$ , $\tau_d = \Sigma(td:x\text{-}y)/10$



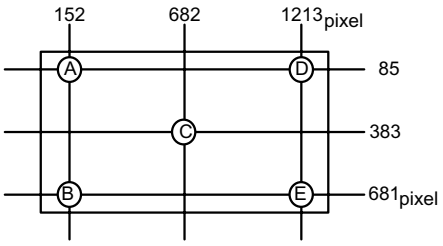

[Note 4]This shall be measured at center of the screen.

[Note 5] This value is valid when O/S driving is used at typical input time value.

[Note 6]Definition of white uniformity ;

White uniformity is defined as the following with five measurements. (A~E)

$$\delta w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$




## 8. Handling Precautions of the LCD module

a) Be sure to turn off the power supply when inserting or disconnecting the cable.
b) Be sure to design the cabinet so that the LCD module can be installed without any extra stress such as warp or twist.
c) Since the front polarizer is easily damaged, pay attention not to scratch it.
d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
g) Since CMOS LSI is used in this LCD module, take care of static electricity and take the human earth into consideration when handling.
h) The LCD module has some printed circuit boards (PCBs) on the back side, take care to keep them form any stressor pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
i) Observe all other precautionary requirements in handling components.
j) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc.. So, please avoid such design.
k) When giving a touch or hit the panel in supplying power, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
l) When handling LCD modules or assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

m) Make sure that the LCD module is operated within specified temperature and humidity. Measures to avoid dust, water, vibration, and heat radiation, etc. are required with cabinet or other way. And image retention may occur if same fixed pattern is displayed for a long time. In some cases, it may not disappear.
Please consider the design and operating environment

## 9. Packing form

a) Quantity of LCD Modules in one pallet: 4 LCD Modules △4
△4 b) Piling number of pallet: 1 maximum
c) Pallet size: 1480 (W) × 575 (D) × 1040(H) mm △4

△3 d) Pallet gross weight : approximately 137.8 kg △4

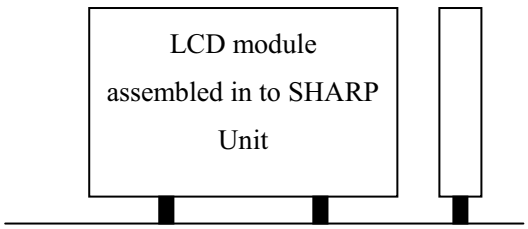
△3 e) Packing Form are shown in Fig. 2
[Note] Pallet transportation is required in mass transportation like Sea, Air, Track, Train or others.

## 10. Reliability test item

| No. | Test item | Condition |
|---|---|---|
| 1 | High temperature storage test | Ta=60 ºC 48h<br>(State of packing) |
| 2 | Low temperature storage test | Ta=-25 ºC 48h<br>(State of packing) |
| 3 | High temperature and high humidity operation test | Ta=40 ºC ; 95%RH 48h<br>(Conditions : Assembled in to the SHARP Unit(PN-V601)/ No condensation) |
| 4 | High temperature operation test | Ta=40 ºC 240h<br>(Conditions :Assembled in to the SHARP Unit(PN-V601)/ No condensation) |
| 5 | Low temperature operation test | Ta=0 ºC<br>(Conditions : Assembled in to the SHARP Unit(PN-V601)/ No condensation/Operation test after five hours power-off) |
| 6 | Vibration test<br>(non-operation)<br>△3 | Frequency : 10~50Hz/Acceleration: (9.8 m/s2)<br>Sweep time : 3 minutes<br>Test period : 1.5 hours (1 hour for direction of Z, 15min for each direction of X, Y,)<br>Ta=25±2 ºC (State of packing) |
| 7 | Shock test<br>(non-operation)<br>△3 | Fall 40cm in height<br>One angle/Two ridges/One aspect of the bottom<br>Ta=25±2 ºC (State of packing) |
| 8 | ESD<br>(operation)<br>△3 | At the following conditions, it is a thing without incorrect operation and destruction.<br>(1)Contact electric discharge +/-4kV<br>(2)Non-contact electric discharge +/-8kV<br>Electric discharge point : bezel screws/operation panel<br>Conditions : 150pF, 330ohm<br>Ta=25±2 ºC , Assembled in to the SHARP Unit(PN-V601) |

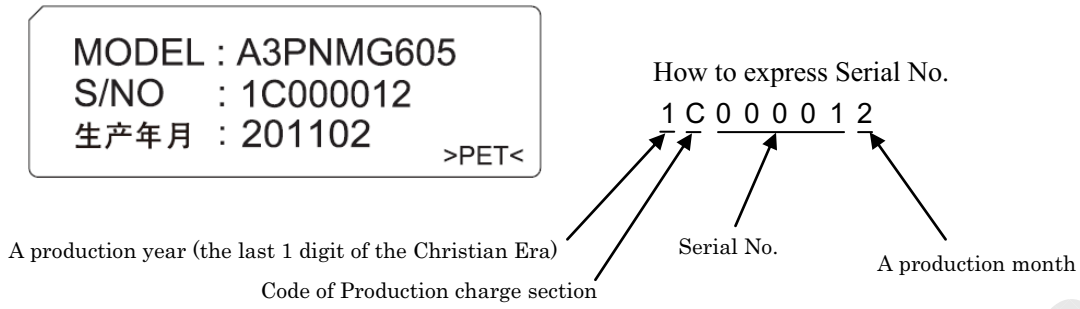
[Result evaluation criteria]
Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

△3 [Note]
In display quality test, LCD module should be put with the surface perpendicular to a level surface like following fig.

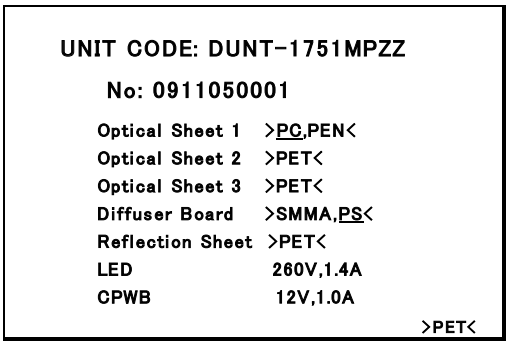



## 10. Others

△3 1)-1 Module Label ;
Module Label is stuck on the back side of the module.




△3 1)-2 Material Label ;
Material Label is stuck on the back side of the module.




2) Disassembling the module can cause permanent damage and should be strictly avoided.
3) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
4) Lead-free soldering is applied.
5) The chemical compound, which causes the destruction of ozone layer, is not being used.
6) Rust on the module is not taken up a problem.
7) Ventilation and cooling measurement should be taken to keep away from high temperature.

## 11. Carton storage condition

| | | |
|---|---|---|
| Temperature | | 0 ºC to 40 ºC |
| Humidity | | 95%RH or less |
| Reference condition | : | 20 ºC to 35 ºC, 85%RH or less (summer) |
| | : | 5 ºC to 15 ºC, 85%RH or less (winter) |
| Sunlight | | Be sure to keep the LCD module away from direct sunlight. |
| Atmosphere | | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected. |
| Notes | | Be sure to keep the LCD module in the carton on palette, don't put it on floor. Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment |
| Storage life | | 1 year |

## 12. Packing form

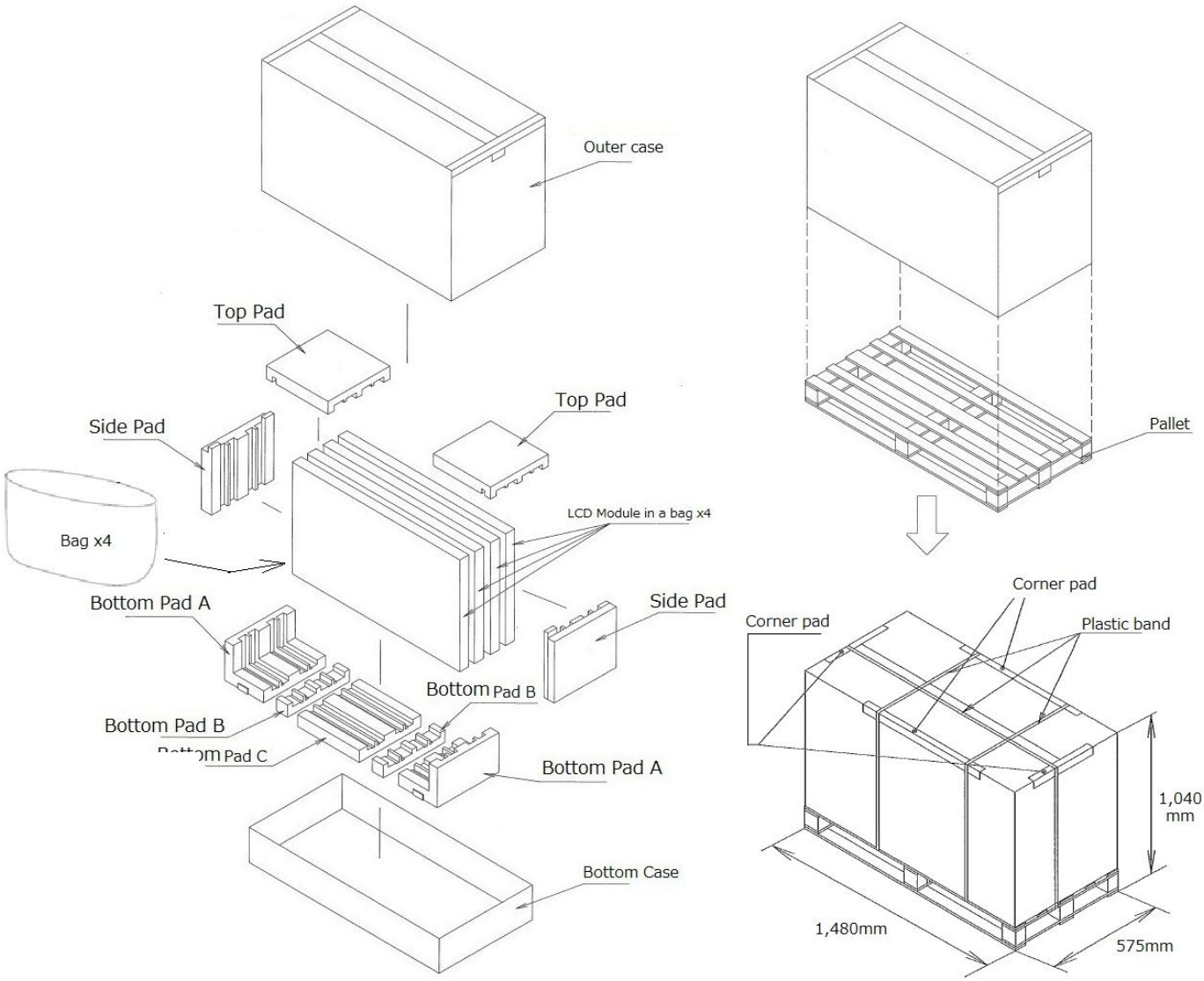



**Fig.2 PACKING FORM**

## 13. Outline dimensions

| Tolerance | |
|---|---|
| description | |
| 0 TO 16 INCL. | ±0.50 |
| OVER 16 TO 100 INCL. | ±0.70 |
| OVER 100 TO 200 INCL. | ±1.00 |
| OVER 200 | ±1.50 |

Unit : mm

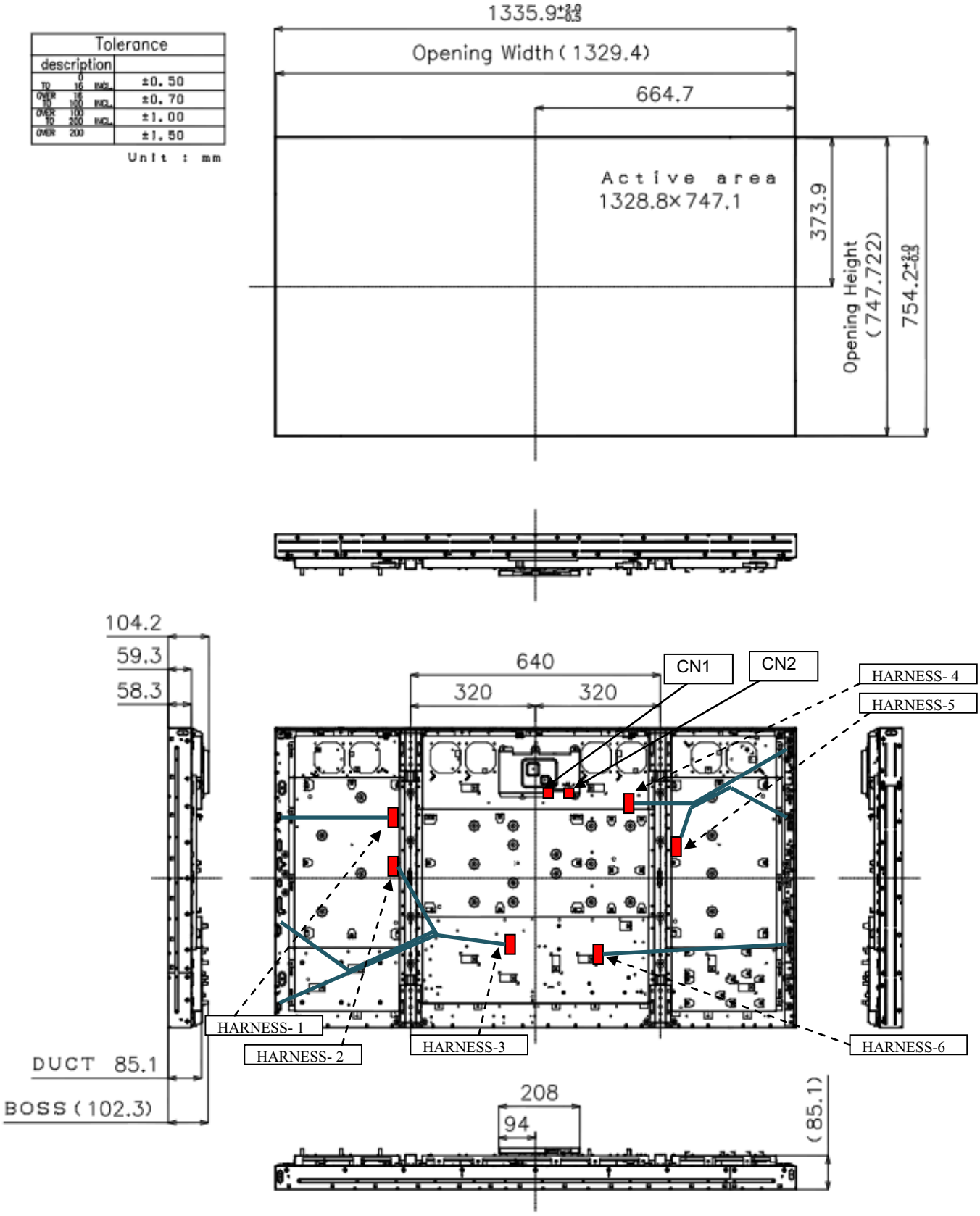



**Fig.3 Outline dimensions**

## △3 14. Environmental Impact Substances Information

### 产品中有毒有害物质或元素的名称及含量

| 部件名称 | 有毒有害物质或元素 | | | | | |
|---|---|---|---|---|---|---|
| | 铅（Pb） | 汞（Hg） | 镉（Cd） | 六价铬（Cr(VI)） | 多溴联苯（PBB） | 多溴二苯醚（PBDE） |
| 液晶组件 (LCD module) | × | ○ | ○ | ○ | ○ | ○ |

○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。